# WATERLOO

## SEWAGE TREATMENT PLANT

## ANNUAL REPORT

1960

PREPARED BY

THE DIVISION OF PLANT OPERATIONS

ONTARIO WATER RESOURCES COMMISSION

# WATERLOO SEWAGE TREATMENT PLANT

The discussion to follow will outline the occurrences at the Waterloo plant in the year 1961. At the last Local Advisory Committee meeting on December 20, 1960, a number of items were discussed which were to be reported on at the next meeting.

1. Operator R. Gellatly

Mr. Gellatly has the status of a temporary employee. With this status he receives all the fringe benefits of a permanent employee such as sick leave, holidays, etc. with the exception that he does not contribute to the superannuation fund. His rate of pay was increased after six months by the same amount as the other operators with similar length of service.

2. Alarm System and 16 Hour Supervision:

The Waterloo Sewage Treatment Plant has been under 16 hour supervision since January 1, 1961 and no serious problems have yet developed. An alarm which will signal a plant power failure has been installed in Mr. May's house.

3. SLUDGE TRUCK

The City of Waterloo purchased a used dump truck for sludge hauling and stationed it at the plant. The price for this truck was $859.66. The O.W.R.C. have paid the bill. Insurance, gas and maintenance on the truck is provided by the city and billed against the O.W.R.C. account. This method of billing will allow the complete cost of sludge handling at the plant to be accounted for.

4. SLUDGE HOIST

The sludge hoist at the plant has caused considerable difficulty and inconvenience ever since it was installed. The unit has broken down on two occasions and has been repaired and redesigned by the manu-

facturer. At the present time, the unit is being completely redesigned and the cost to improve the complete hoist is $700.

5. DIGESTERS

The two existing digesters have survided the winter months with no apparent damage. At present, these units are completely full of sludge and this sludge will have to be removed by either liquid haulage or filtering.

6. POWER FACTOR & POWER COSTS

The present substation consists of a 750 KVA, 4160-600 volt, 3 phase transformer and 5KV primary switch gear. This substation equipment was provided by the O.W.R.C. at an estimated cost of $8500. This substation should provide a power cost saving of about $500 per year based on a load of 500 KW.

A new 13.8 KV substation would cost approximately $10,000 and if the load was increased to 600 KW the saving would be $600 per year. The question of an addition of a larger substation then becomes a problem in economics wherein equipment worth $8500 saving presumably $500 per year in power cost has to be replaced by equipment valued at $10,000 which would save $600 per year.

There are two possible solutions to this problem:

(a) Retain the present 5 KV substation until a third blower is added which would increase the load to 650 KW, and then a fair portion of the cost could be "written off". This solution assumes that the third blower will not be added for several years.

(b) In the event another location could be found to take the existing 5 KV substation, it might be worthwhile to make the change now to the 13.8 KV substation. Unfortunately finding another location for the

substation would present a problem because the power must be supplied at 4,000 to 4,200 volts.

The problem therefore resolves itself into a consideration of what the total difference in price would be to switch from the present substation to a new one for an estimated power saving of $100 per year.

The problem of low power factor at the plant has been considered and as yet a clearcut understanding of the situation has not been possible.

Each of the two 200 HP blower motors have been equipped with 40 KVAR capacitors which improve the power factor. Without the capacitors, the power factor could be as low as 74% and with the capacitors it would increase to 90 or 95%.

To make a complete analysis of the power problems at this plant, it will be necessary to engage the assistance of the local P.U.C. The P.U.C. could be requested to provide power factor readings and include actual corresponding kilowatt values at the location of their metering equipment on the 550 volt bus.

The plant could then be run under the following conditions:

(a) With both 200 HP blower motors in operation and as much as possible of the remaining electrical equipment in the plant in operation, including electrical heating and lighting.

(b) With both blower motors off and all other electrical equipment in operation.

(c) With one blower motor on and other electrical equipment in operation.

From (a) and (b) the amount of power factor correction for two blower motors can be determined and from (c) the correction for one blower motor. The correction, if any, required by the balance of the

electrical equipment can also be determined.

7. AIR CHECK VALVES

The original check valves supplied at the plant were generally unsatisfactory. After a considerable delay, during which the manufacturer in the U. S. was bought out, the check valves were completely redesigned and rebuilt by the parent company and were put in on a one month trial basis. The valves lasted over a month but soon disintegrated.

At this point, the Canadian suppliers agreed to supply free of charge two replacement check valves manufactured by a Canadian firm. In order to replace the old check valves with the new ones, an additional filler piece was required because the new valves were five inches shorter than the old ones.

A series of meetings were held and it was decided to try to reduce the noise and vibration level by making the filler piece out of rubber. The valve suppliers contacted a rubber company to manufacture two filler pieces. Considerable difficulties and delays were encountered and finally a new design was incorporated and shipped to the plant.

8. VACUUM PUMP

The initial problem of the vacuum pump on the coil filter seizing has apparently been solved. At present, two Micromet feeders have been installed and crystals are added every month. Since the installation of the second feeder, we have had no seizure. Proctor and Redfern have already designed a closed water seal system which can be used if the present feeders prove unsuitable.

9. PIPING ALTERATIONS

The alteration in piping to permit wasting of activated sludge to the filter or the digesters as well as the primary clarifier has been finished.

10. FOAM CONTROL

The spray system for foam control has been constructed and only minor adjustments are needed to put it into operation.

# WATERLOO SEWAGE TREATMENT PLANT

## Annual Report

## SUMMARY OF PLANT PRIOR TO TAKEOVER

The proposal to provide an addition to the Waterloo Sewage Treatment Plant had been discussed for some years, and in May 1956 Proctor & Redfern, Consulting Engineers, submitted a report which recommended that an addition to the plant be constructed to provide secondary treatment for 4 M.G.D.

On August 10, 1956, discussions were held between the city and the OWRC regarding the estimated $617,300 extension to the plant. Further discussions between the city and the consultants confirmed that the estimated cost for the project would be approximately $660,000. On January 24, 1958, the O.M.B. granted tentative approval for the addition.

During 1959 and the early part of 1960, Ball Brothers Construction Company completed the addition.

The Division of Plant Operations assumed the responsibility of treating sewage at the Waterloo sewage plant on April 1, 1960 and since that time has been plagued with a series of operating difficulties. This has resulted in periodic discharges of unsatisfactory effluent, increased operating expenses and has been most demoralizing to the plant operators as well as the Division head office staff.

## CHARACTER OF RAW SEWAGE

The extension to the Waterloo plant was designed on information contained in a report of Proctor & Redfern, Consulting Engineers, dated May, 1956. The flow figures, BOD and suspended solids for the raw sewage were obtained from investigations and sampling extending over some three years. These figures, it appears, were reliable for the time.

Our investigation has shown there has been a significant increase in the BOD of the raw sewage since 1956 and a graph showing this increase is now under preparation.

Shock discharges of industrial wastes have frequently upset the plant adding to the problem of operation. These shock loads were not only BOD and suspended solids, but also pH. A recording pH meter was installed on the plant influent for several weeks this summer and recorded pH figures as low as 3.5 and as high as 11.5 for one or two hours duration several times per week. With this type of raw sewage, treatment became impossible.

The change in character of the raw sewage has left no reserve capacity in the plant. The two existing air blowers must be kept running continuously or the aeration section will turn septic. This has already happened when check valves on the blowers broke and the starter unit for one burned out.

An industrial waste survey was done in Waterloo and separate reports covering Carling Breweries and Joseph E. Seagrams have been submitted to the City of Waterloo and the appropriate industries.

## EQUIPMENT DIFFICULTIES

More than usual initial operating difficulties have been experienced with the new equipment. These difficulties will not be discussed in detail, but the more important ones will be mentioned.

The vacuum filter was originally sized for digested sludge and a small quantity of sludge. The change in character of the raw sewage, as mentioned above, is the cause for the increase in sludge quantity. With the increased quantity of sludge to be handled it is necessary to operate the sludge filtering equipment at faster rates for prolonged

periods. This additional operation has increased the operating costs because additional operators are required, additional chemicals and the fact that equipment maintenance is greater.

The delay in providing an adequate water supply greatly hindered sludge handling operations in the beginning. Mechanical faults in the water pressure system also added to the dilemma. The hardness of this water (approximately 1500 ppm) is now causing new troubles. The vacuum pump for the sludge filter has seized a number of times due to the buildup of scale on the close tolerances. Because there is only one vacuum pump the breakdown of this unit has meant a shutdown of sludge filtering and complete disruption of our sludge disposal routine. It should be pointed out that the Plant Operations Division has provided technical assistance on many occasions to put the vacuum pump back into operation.

The skip hoist used to convey the filtered sludge from the conveyor belt to the elevated storage hopper has been a constant source of annoyance and danger since it was put into use. The hoisting mechanism was re-designed by the manufacturer after if failed once, but it is still not completely satisfactory. Up until the end of 1960, the skip hoist had to be manually operated and its slow speed of travel used one operator full time. The skip hoist is now operating automatically.

The excessive noise and vibration of the two compressors has been a constant source of annoyance and difficulty. The noise has made working in the blower room extremely difficult and has been a source of complaints from a local resident. The vibration associated with the noise has been instrumental in the difficulties encountered with the check valves. Two sets of check valves have been destroyed and new valves are being installed by the supplier.

Difficulties have also been encountered with the diaphragms on the chemical pumps located in the basement. A high pumping head plus the need to pump larger amounts of chemicals due to the greater amount of sludge has caused several of these diaphragms to rupture.

EXISTING TREATMENT WORKS

The project at Waterloo consisted of adding secondary treatment to an existing primary plant. This plant, while less than 15 years old, had deteriorated badly, due, once more, to the character of the raw sewage.

As mentioned earlier, the scraper mechanism of the primary sedimentation tank has deteriorated badly, and will need a complete overhaul and painting, no later than next spring if it lasts that long. The grit rake mechanism, flow recorder and old sludge pump had to be rebuilt. The delay in renovating the old control building to provide laboratory space, office space, and facilities for the men created extra hardships and difficulties. Proper laboratory control, so necessary at this stage of a new plant, was not possible. The proper laboratory control was not achieved until the end of the year.

In the original design of Proctor & Redfern for the Waterloo Sewage Treatment Plant, no consideration was given to the renovation of the two existing digesters. The proposal for sludge disposal was the filtering of digested sludge.

When the project was nearly completed, an investigation revealed the poor condition of the two existing digesters and considerable repair work and renovations were found to be necessary. The cost of mixing equipment for the primary digester alone came to over $29,000 and a rough estimate of $50,000 was given to completely rehabilitate both units. This extra expenditure would exceed the amount approved by the O.M.B. and it would have been necessary to go back for further approval on this work.

As a result, the feasibility of filtering raw sludge was considered. This was an established practice in the U. S. The Local Advisory Committee gave approval to this proposal with the understanding that if the experiment was not successful the original proposal of digester renovation would be followed. There are certain renovations necessary to these units in order to use them merely as holding tanks.

When the plant was accepted from the City of Waterloo for operation last April, the digesters were full of old sludge and probably sand. These digesters have to be emptied in order to use them as holding tanks. Similarly, the sludge lagoons on the property were full and this sludge must also be removed. The sludge removal will entail considerable initial operating costs which should not occur as a regular expenditure.

SUMMARY OF OCCURANCES

On May 2, 1960 at 12:30 PM sewage was run into the aeration section of the Waterloo Sewage Treatment Plant and through one final sedimentation tank. On this date, the primary clarifier was bypassed in order to proceed with repairs and painting.

On May 3, 1960, the three new operators started to work. R. Gellatly, B. Snider and H. Carter.

Early in June the aeration tanks turned septic and a newspaper report on June 9 indicated that the septic conditions at the plant had caused many complaints of odors.

On June 8, an engineer from the Plant Operations Division investigated the septic conditions. The primary cause for the septic condition was the extremely heavy load of solids being carried in the aeration section at a time when one blower developed a hot bearing and had to be shut down during the weekend of June 4-5. When the blower had to be shut down, there was no way to waste solids from the aeration system because the primary sedimentation tank was out of service. Consequently, the oxygen demand rose above the capacity of one blower and the plant turned septic.

On June 9, the primary sedimentation tank was put back into service despite the fact that the cleaning and painting had not been completed.

During the latter part of June an attempt was made to start filtering raw sludge. The technician from Komline-Sanderson attempted to start up the filter. Since the permanent well system was not installed various methods of providing water were attempted including pumping

from Laurel Creek, pumping plant effluent and finally using a head office centrifugal pump with its suction line pushed down the drilled well.

Joseph E. Seagrams Company dumped 30,000 gallons of wine pulp during July 15 and 16 turning the sewage black. During the rest of July, the plant was subjected to many problems. The plant began bulking due to insufficient aeration, the skip hoist wasn't working properly, the check valves on the air lines were damaged and the sludge filtrate pump was found to be too small and the discharge line too small.

There was considerable difficulty in obtaining delivery of ferric chloride via rubber-lined tank truck so Komline-Sanderson had carboys of the chemical delivered in order to start up the filter.

In the latter part of July, complaints were received from local citizens regarding the noise from the blowers. On August 10, a meeting was held at the plant with all persons conerned with the plant. The air troughs in the aeration system were filled with sand and the blower intakes were raised above the roofline.

Early in August, F. Hamer was hired on a casual basis to replace D. Geiger who quit. During the rest of August, the damaged check valves remained unrepaired and the plant was still without water. Late in August another slug of wine waste entered the plant.

During September the plant alternated between normal operation and a bulking condition depending on the industrial waste which entered the plant.

During October vacuum filtration of sludge commenced 7 days per week and a sludge hauling contract was entered into with a local trucker. On October 31 the vacuum pump seized due to scale buildup.

On November 3 the check valves on the air lines were reinstalled on a 30 day trial basis with the understanding that the supplier would replace the valves if they were found to be faulty. During November, there was a turnover with the casual staff.

During the month of December the vacuum pump seized a number of times, but the plan effluent was generally good.

# WATERLOO SEWAGE TREATMENT PLANT

## OPERATING RESULTS

### FLOW RECORDERS

| MONTH | Avg. Daily Max. MGD | Avg. Daily Min. MGD | Avg. 24 hr. Flow M.G. | Total Recorded Flow M.G. |
|---|---|---|---|---|
| January | 3.3 | 0.8 | 2.2 | 64.8 |
| February | 3.0 | 0.5 | 1.9 | 52.5 |
| March | 3.5 | 1.0 | 2.4 | 70.5 |
| April | 4.2 | 1.6 | 3.1 | 81.6 |
| May | 3.7 | 1.3 | 2.7 | 78.1 |
| June | 3.6 | 1.1 | 2.6 | 77.2 |
| July | 3.2 | 0.7 | 1.9 | 53.2 |
| August | 3.0 | 0.4 | 1.9 | 58.0 |
| September | 2.9 | 0.2 | 1.6 | 45.5 |
| October | 3.0 | 0.3 | 1.6 | 50.5 |
| November | 2.9 | 0.5 | 1.4 | 45.5 |
| December | Meter away for repairs | | | 45.0 |

Total estimated yearly flow 712 million gallons.

Total estimated flow from May to December = 453 million gallons.

Total expenditure from May to December $34,233

Cost per M.G. = $\frac{34233}{453}$ = $ 75.50

Cost = 7½¢ per 1,000 gallons.

With 20,000 population Cost/cap. = $\frac{34233}{20000}$ = $1.71 per 8 months

= 1.71 x $\frac{12}{8}$ = $2.57 per year

= .7¢ per day

# WATERLOO SEWAGE TREATMENT PLANT

## OPERATING RESULTS

| | Cu. Yds. of Sludge Filtered | lbs. of Ferric Chloride used | lbs. of Lime used | Hrs. of Filtering time | Hrs. of Trucking time | Total Chemical Cost |
|---|---|---|---|---|---|---|
| October | 362 | 3206 | 16160 | 118 | 46.5 | $ 325 |
| November | 488 | 6187 | 26150 | 155 | 66.5 | 586 |
| December | 418 | 5322 | 24150 | 138 | 47.0 | 518 |

# WATERLOO 1961 BUDGET ESTIMATE

## PAYROLL

| | | | |
|---|---|---|---|
| Chief Operator | | $ 5,250 | $ 5,250 |
| 1-operator | | 3,750 | 3,750 |
| 4-operators | @ | 3,480 | 13,920 |
| 1-operator | @ | 3,360 | 3,360 |
| | | TOTAL PAYROLL | $ 26,280 |

## FUEL

1200 gallons per month for 5 months = 6000
300 gallons per month for 7 months = 2100
Total cost with approx. 8000 gallons x 14 $ 1,120

## POWER

Since July average approx. $1300 per month
Total power cost for 12 months $ 15,600

## CHEMICAL

### Filtering

Avg. from August to December = $700 per month
Estimate $500 per month for 12 months $ 6,000

### Chlorination

Estimated total flow from May-Sept. = 500 M.G.
Avg. dosage = 4 ppm
Estimate chlorine consumption = 20,000 lbs.
Estimated cost = 200 x 14 = $ 2,800 $ 2,800

## GENERAL SUPPLIES

Avg. from May-Dec. = $200 per month
Estimate $100 per month for 1961 $ 1,200

# WATERLOO 1961 BUDGET ESTIMATE

## EQUIPMENT

| | |
|---|---|
| Estimate $500 in 1961 | $ 500 |

## REPAIR & MAINTENANCE

| | |
|---|---|
| Estimate $ 1500 | $ 1,500 |

## SLUDGE HAULAGE

| | | |
|---|---|---|
| Purchase of truck from city | $ 900 | |
| Contractors bills remaining | $ 200 | |
| Repairs, gas, etc. on truck | $ 500 | |
| TOTAL | $1600 | $ 1,600 |

## SUNDRY

| | |
|---|---|
| Avg. from May to Dec. $65 per month<br>Estimate for 12 months = 12 x 65 approx. | 800 |
| TOTAL Estimated Cost | $ 57,400 |
| Contingencies 5% of $57,400 = $3,000 approx. | 3,000 |
| Operating Budget | $ 60,400 |

Estimate cost = $8\frac{1}{2}¢$ per 1000 gallons

WATERLOO

YEARLY OPERATING COSTS 1960

| Month | Expenditures | Payroll | Casual Payroll | Fuel | Power | Chemical | General Supplies | Equipment | Repair and Maintenance | Sludge Haulage | Sundry |
|---|---|---|---|---|---|---|---|---|---|---|---|
| May | 1404.18 | 1315.22 | | | 35.03 | | 28.13 | | | | 25.80 |
| June | 2691.07 | 1729.58 | | 38.04 | 727.87 | 54.75 | 37.03 | | 5.75 | | 98.05 |
| July | 4408.91 | 2596.89 | | 60.75 | 1212.83 | 320.28 | 119.69 | | | | 98.47 |
| Aug. | 6207.54 | 1781.24 | 324.00 | 68.20 | 1390.25 | 1562.20 | 397.49 | 566.23 | 12.99 | | 104.96 |
| Sept. | 2626.97 | 737.12 | 116.64 | 6.75 | 1300.97 | | 317.49 | | 88.00 | | 60.00 |
| Oct. | 4637.61 | 2660.18 | | 9.25 | 1279.04 | 319.27 | 310.56 | | | | 59.31 |
| Nov. | 3770.15 | 1804.86 | 187.92 | 135.82 | 1431.57 | | 180.18 | | | | 29.80 |
| Dec. | 8486.59 | 2836.38 | 510.76 | 494.21 | 1503.59 | 1730.71 | 270.87 | 435.12 | | 650.00 | 54.95 |
| TOTAL | 34233.02 | 15461.47 | 1139.32 | 813.02 | 8881.15 | 3987.15 | 1661.44 | 1001.35 | 106.74 | 650.00 | 531.34 |

# WATERLOO

EXPENDITURES IN 1961

The following is a list of items that should be purchased in order to bring the plant up to a normal and efficient condition:

1. Painting of the floor in the control building.
2. Repair, sandblasting, and repainting of the primary sedimentation tank.
3. Cleaning out of the two old digesters and sludge lagoons.
4. Rewiring when found necessary.
5. Repair, sandblasting and repainting of the metal roofs of the digesters.
6. Repairs, maintenance and improvements of grounds, roads and sidewalks.
7. Improvements to the sludge hopper and skip hoist mechanism.
8. Additional handrailings around the plant.